plate and transverse-flow plates by means of gaskets of suitable materials, such as flexible, compressible graphite, ceramic or vermiculitic materials. The use of gaskets allows easy inspection and replacement of the plates. Accordingly, the gasketed assembly is the preferred embodiment of cells and stacks of the invention for the purpose of testing catalysts.

[0038] The relieved intake and outlet regions **60, 62** to the entry and exit ends of the gas flow channels **40** will not provided adequate support to permit a good seal to the separator plate. The resulting reduced gasket pressure results in the probability that leakage may occur in this region. According to a second design and assembly aspect of the present invention, this leakage problem is solved by use of metal frames that sandwich the transverse-flow plates to provide the necessary metal support for the gaskets to safely seal.

[0039] **Fig. 3** is an exploded isometric view of a sub-assembly comprising a transverse-flow plate or platelet **2** and two metal plate or platelet frames **10** and **12**. Metal frames **10** and **12** are joined by brazing to transverse-flow plate **2** to form unit **F**. Unit **F** is similar to transverse-flow plate **2** in **Fig. 1**, and it may be use in place of that transverse-flow plate. Following a similar procedure, a unit **G** similar to transverse-flow plate **3** in **Fig. 1** can be assembled. In the partial stack of **Fig. 1**, gaskets made of a suitable material (Grafoil brand flexible sheet graphite, Vermiculite, Ti foil, Nitrided Ti) reproducing the shape of the metal frames **10** are placed between the unit **F** and face **1a** of the thin separator plate **1**, and between the unit **G** and face **1b** of the thin separator plate **1**. For clarity, the gaskets are not shown in **Figs 1, 2** or **3**, but they are shown in **Fig. 4**, and described in more detail below. The gaskets are similar in shape to the plates **10, 12** and they are inserted between those plates and the corresponding separator plates. Note that the areas **66, 68** of the plates **10, 12** support, respectively, the relieved areas **62, 60** of the transverse flow plates **2, 3**, respectively. Thus, this embodiment of the inventive plate reformer is sealed with gaskets for easy assembly and disassembly.

[0040] **Fig. 4** is a section view through line **4 – 4** of **Fig. 3**, and it shows the metal support frames **10, 12** sandwiching the transverse flow plate **2**. Frame **10** is in contact with a gasket **72**, such as flexible compressible graphite, (e.g., Grafoil brand flexible sheet graphite sealing material) which in turn is in contact with the thin metal bi-catalyst coated separator plate **2**. The bore **44** permits introduction of the combustion gas, which passes into the flow channel **40** via the relieved portion **60** of the transverse flow plate **2**. The bottom gasket layer **72'** would be in contact with a support frame **10** of the unit **G** (see **Fig. 3**).

C. Flow Redirecting Devices

[0041] Efficient operation of the plate reformer requires thorough contact of the gas streams with the catalytic walls. Redirecting the gas flow towards the catalytic wall enhances contact between the gas stream and the catalytic wall. Thus, according to a third aspect of this invention, flow-redirecting devices are introduced within the inter-plate voids **40** of transverse-flow plates **2** and **3** in **Figs 1 - 3.**

[0042] **Fig. 5** is an enlarged isometric view of a grooved plate flow-redirecting device **80** placed in the void **40** of the transverse flow plate **3**. At least one, and preferably both faces **82, 84** of the insert **80,** are grooved to provide passage for the gas to be directed to flow close to the catalytic wall. The insert material may be any suitable temperature-resistant inert material such as stainless steel, titanium, nitrided titanium, block graphite, ceramic, cer-met, or combinations thereof. In addition, the grooved surfaces can be coated with catalyst before insertion in the void area **40**. The grooves can be any suitable longitudinal and cross-sectional shape, such as sinusoidal, V-bottomed, semicircular, U-bottomed or square cut, and the like.

[0043] A second type of flow-directing device is shown in **Fig. 6**. The void **40** in the transverse-flow plate **3** is filled with spheres **86** to redirect the gas flow towards

the catalytic walls. Preferably the spheres are fused together at contact surfaces to form a rigid insert, rather than the void **40** being filled with loose spheres.

[0044] **Figure 7** is an isometric exploded view of a complete reformer stack showing the orientation of the plates as called out in **Fig. 1**, and with the addition of insulation spacers **90** and end plates **92** at each end. The insulation spacers provide an insulating void that optionally can be filled with insulating material. The separator plates **1-C** and **1-B** need not, but may be coated with catalyst **C**. The inlets and outlet feed and exhaust pipes are shown in **Fig. 1**. In addition, bolt holes **94** are spaced around the periphery of the end plates and aligned so that fastening rods may be inserted an tightened down with nuts (not shown).

[0045] It is recognized that those skilled in the art may make various modifications or additions to the present best mode embodiments of the apparatus without departing from the spirit, scope and intent of the present invention and that the present invention is not limited to these preferred embodiments. For instance, positions of the passages for the gas streams, and each inlet/outlet opening for fuel, reformed gas, etc., may be changed from the positions shown in the figures. In addition, the number of units stacked in the reactor may be more than the two shown in **Fig 1** or **Fig 7**. The grooves in the slab-shaped flow-redirecting device need not be straight, e.g., they may be sinusoidal, and they could have relatively sharp bends or kinks, or the depth need not be uniform or partial obstructions placed in the grooves, to induce turbulence. Finally, one or more layers of spheres may be included in the flow-redirecting device shown in **Fig. 6**.